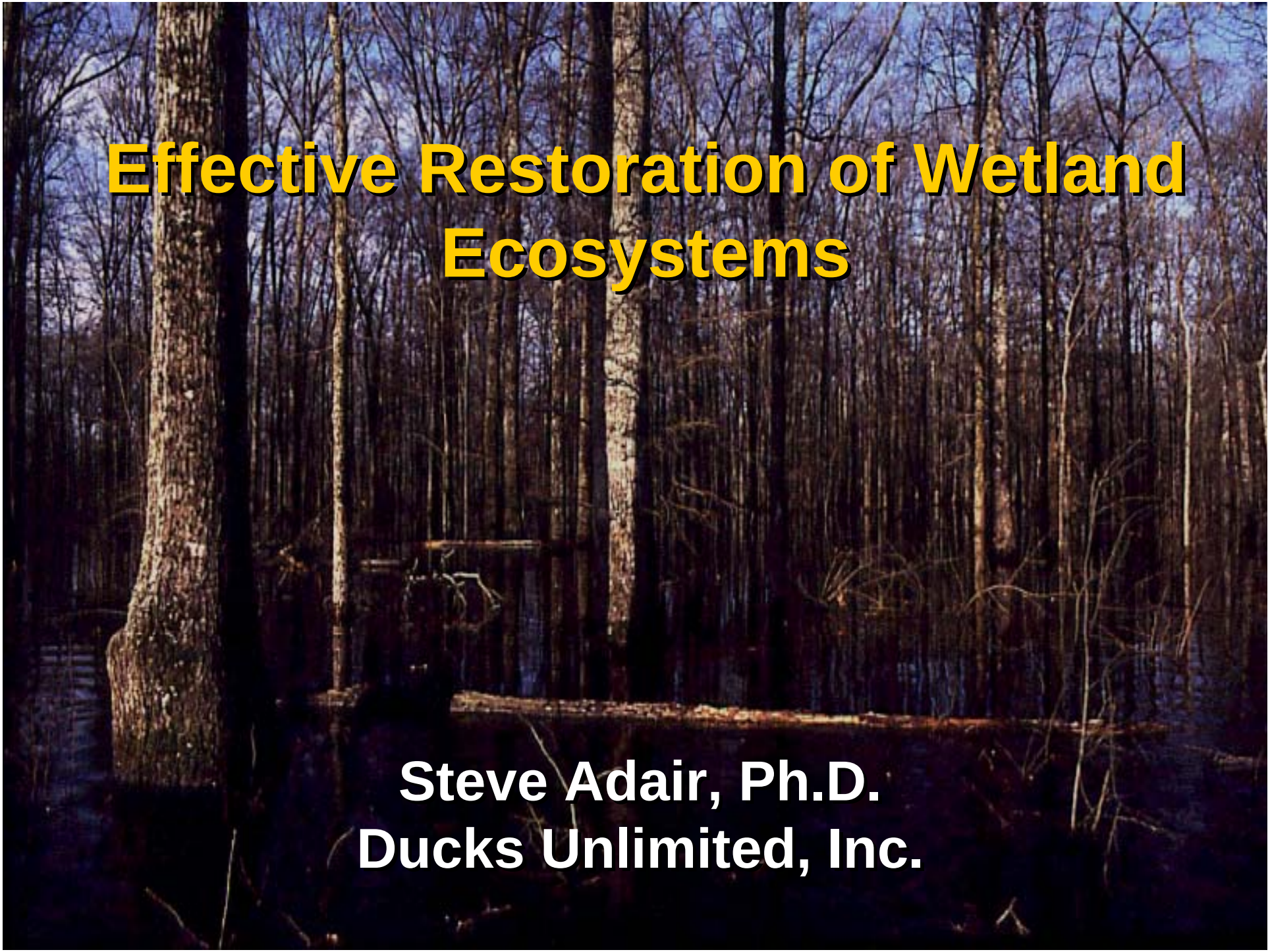


Effective Restoration of Wetland Ecosystems

Steve Adair, Ph.D.
Ducks Unlimited, Inc.

What is Restoration?

“The return of an ecosystem to a close approximation of its condition prior to disturbance”

National Research Council

“The goal is to emulate a natural, functioning, self-regulating system that is integrated with the ecological landscape in which it occurs”

Long-term Floodplain Processes

"Over geologic time scales, plant and animal communities change with broad scale climatic and geomorphic processes"

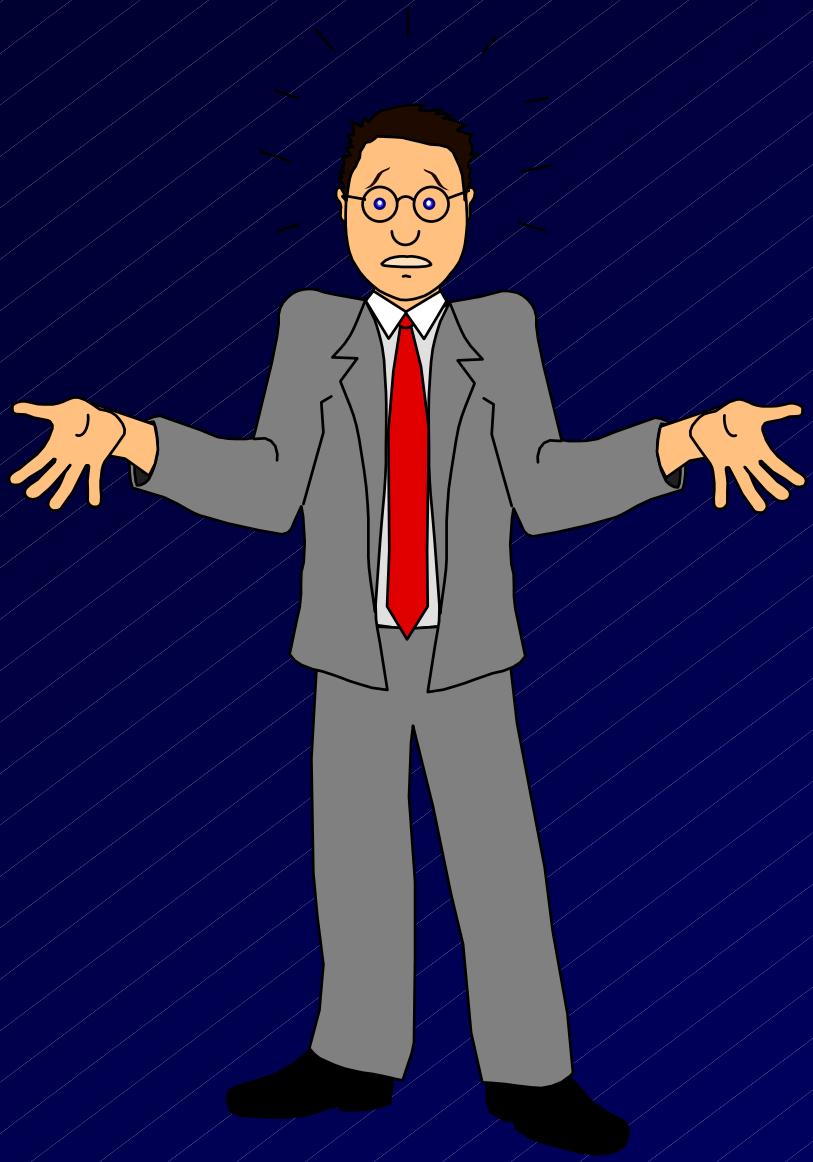
- **Broad-scale climatic patterns: Glaciation, sea level changes, precipitation cycles.**
- **Geomorphic Processes: Long-term sediment deposition and erosion.**

Short-term Floodplain Processes

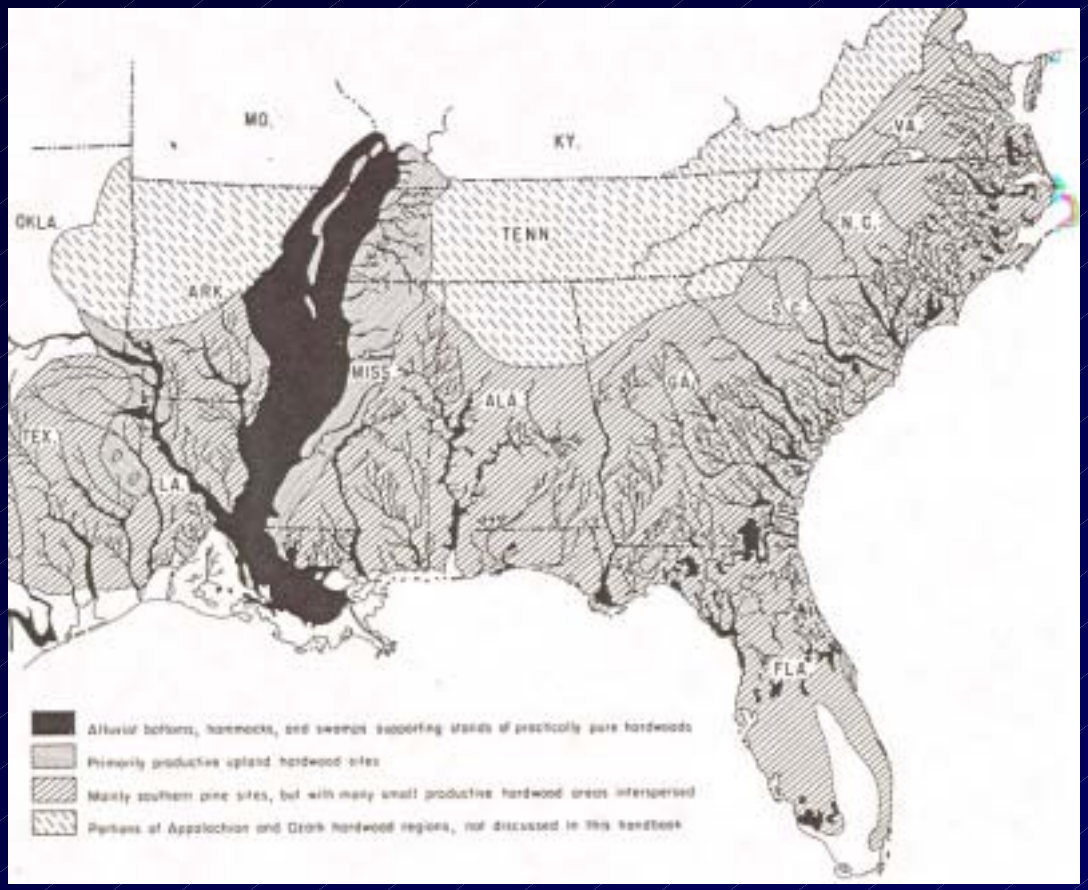
"Among years, plant and animal communities change with site specific changes in hydrology, nutrient dynamics, and ecosystem structure"

- Hydrology: The depth, duration, source, and timing of flooding.
- Nutrient dynamics: The major chemical sources, sinks, and pathways.
- Ecosystem structure: The size, composition, age structure, and juxtaposition of plant and animal communities.

The Need for Restoration?

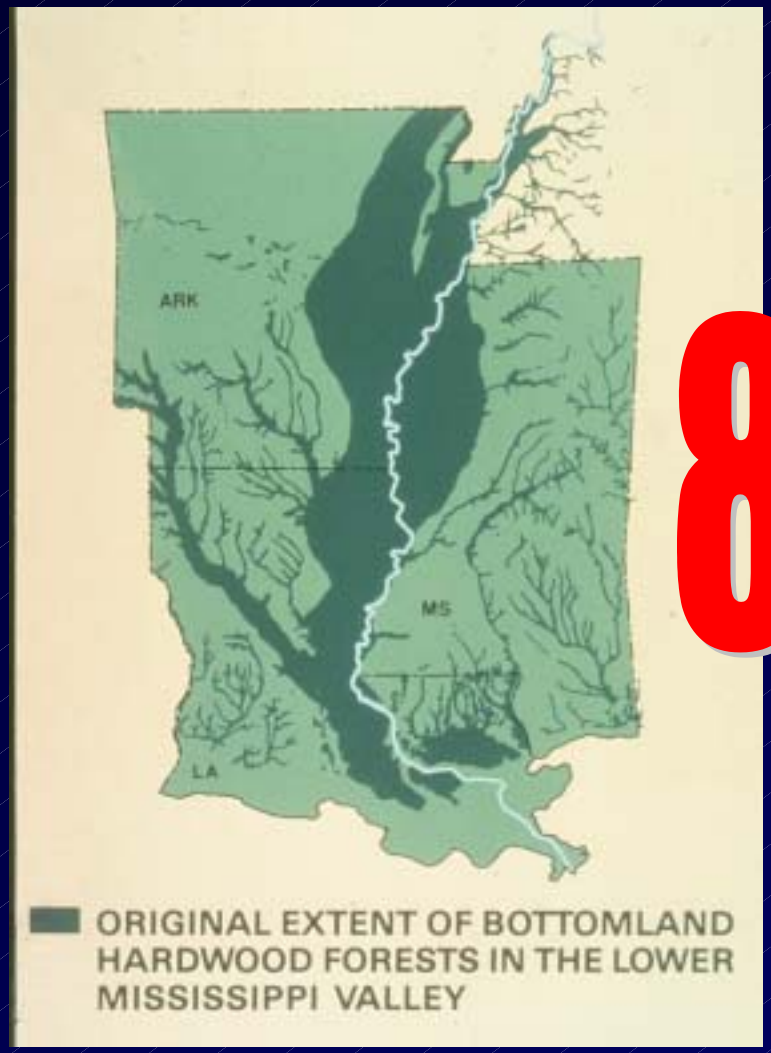


Bottomland Hardwood Distribution

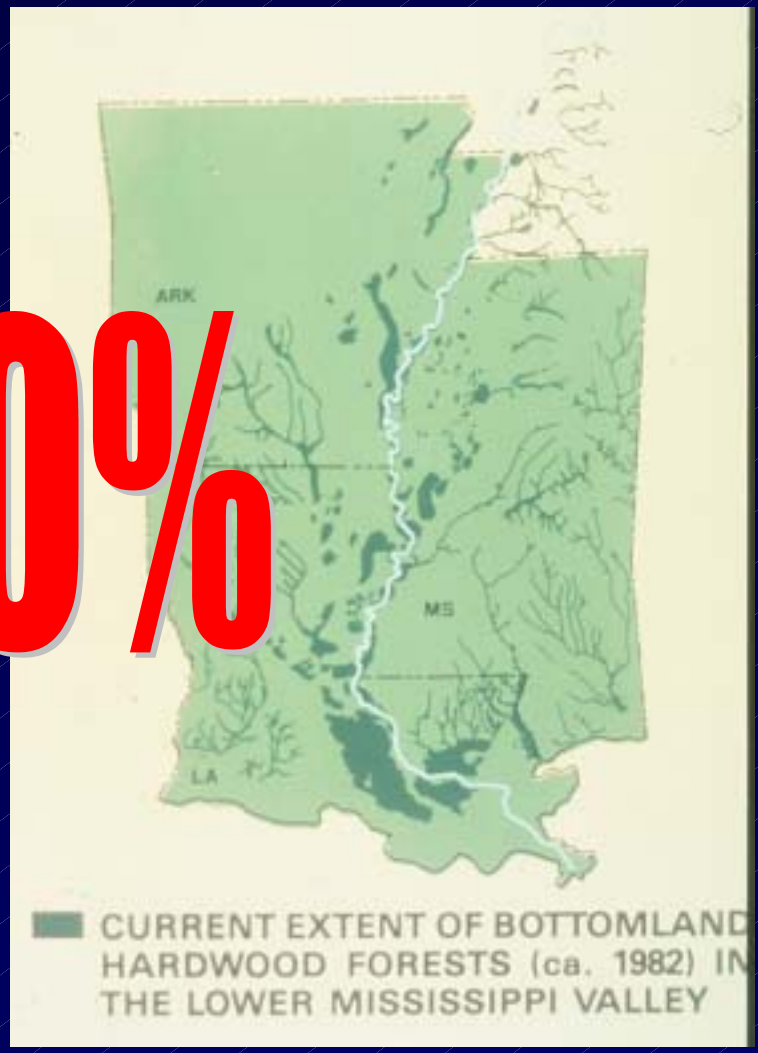


- Vast forests on eastern river floodplains
- Seasonal flooding when river levels rise
- Vegetation characterized by water tolerant oaks, red maple, green ash, elms, sweetgum

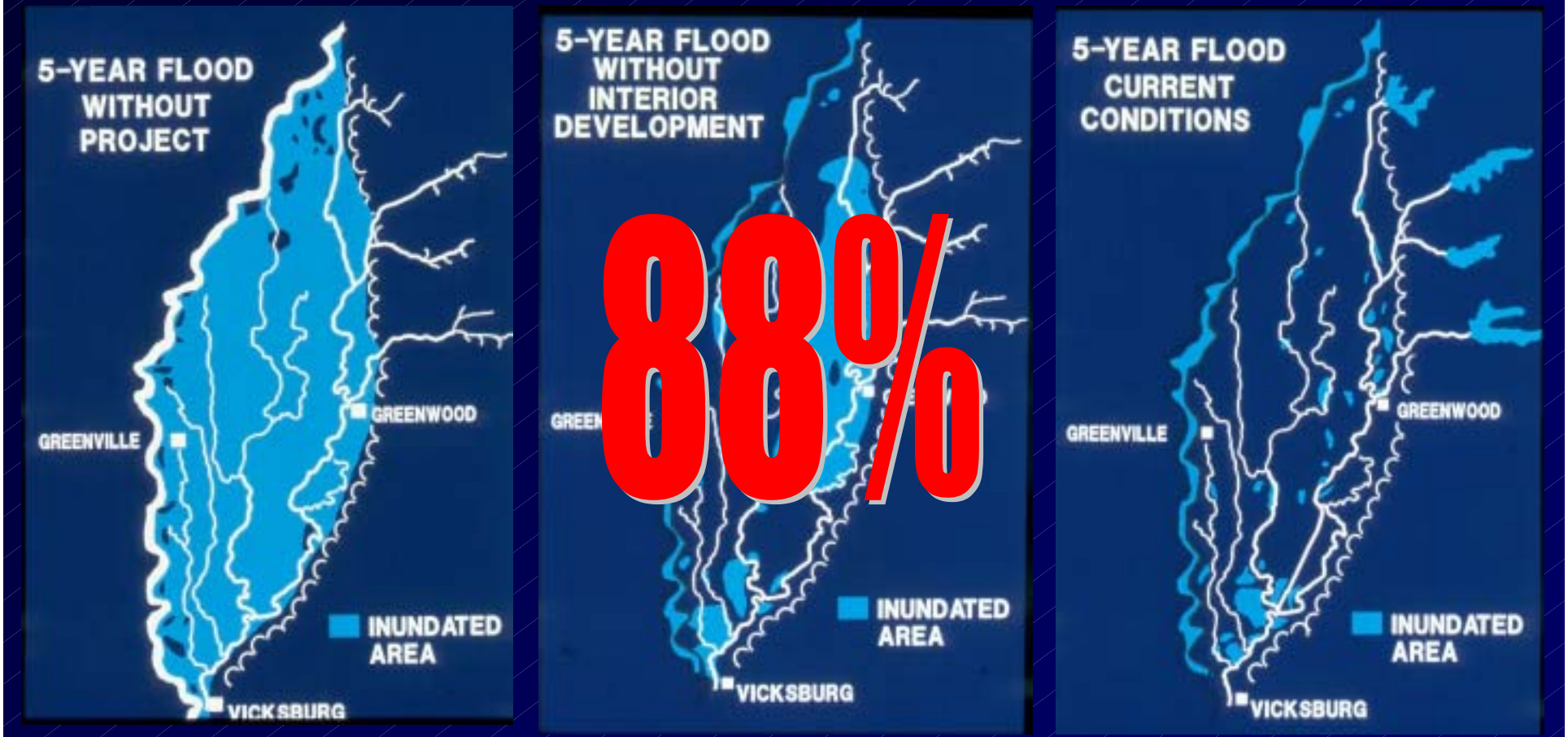
How has the MAV Changed Over Time?



80%

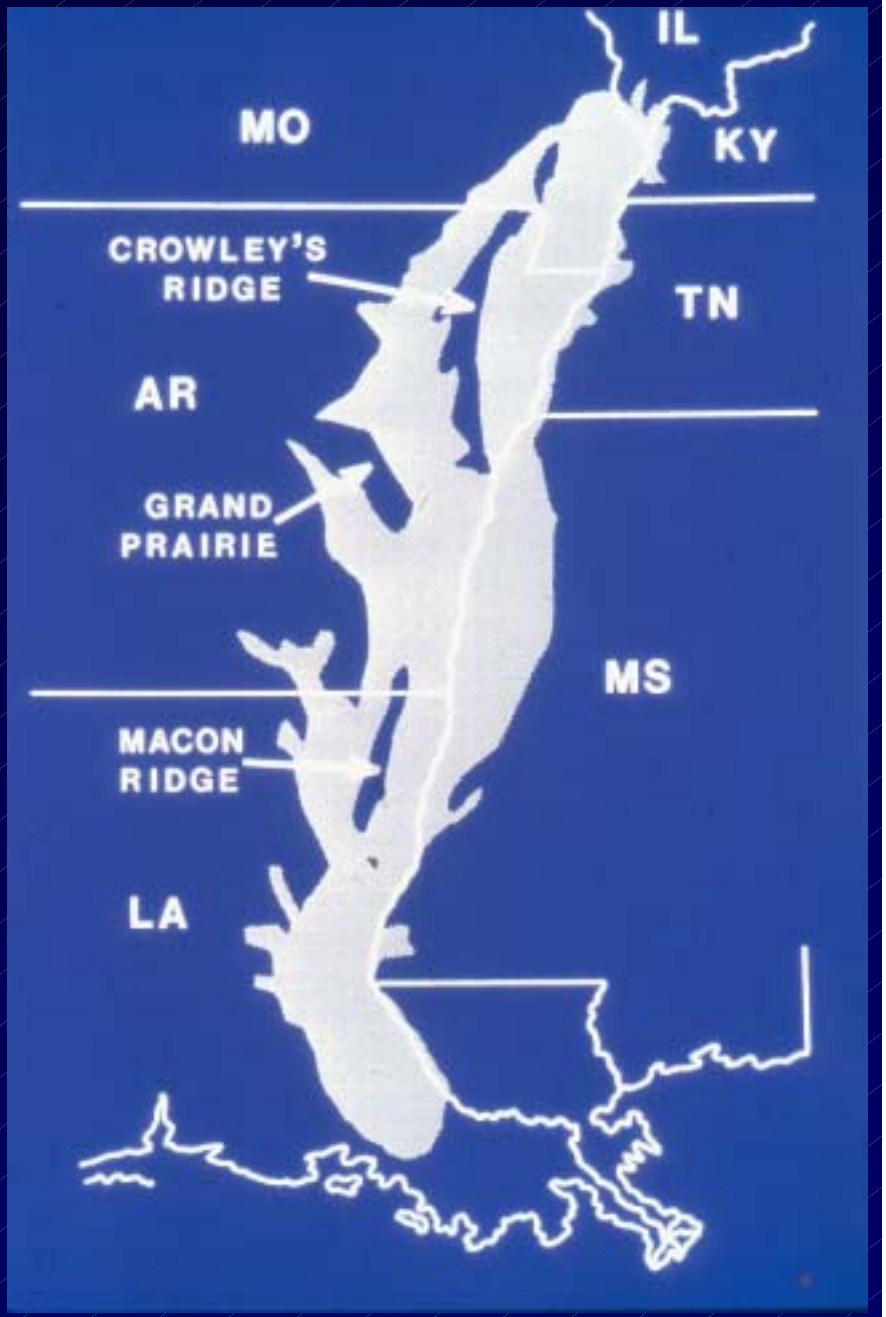


How has the MAV Changed Over Time?



The Mississippi Alluvial Valley

...the MAV is the most important wintering area for midcontinent mallards in North America and probably in the world (1-5 million birds annually).



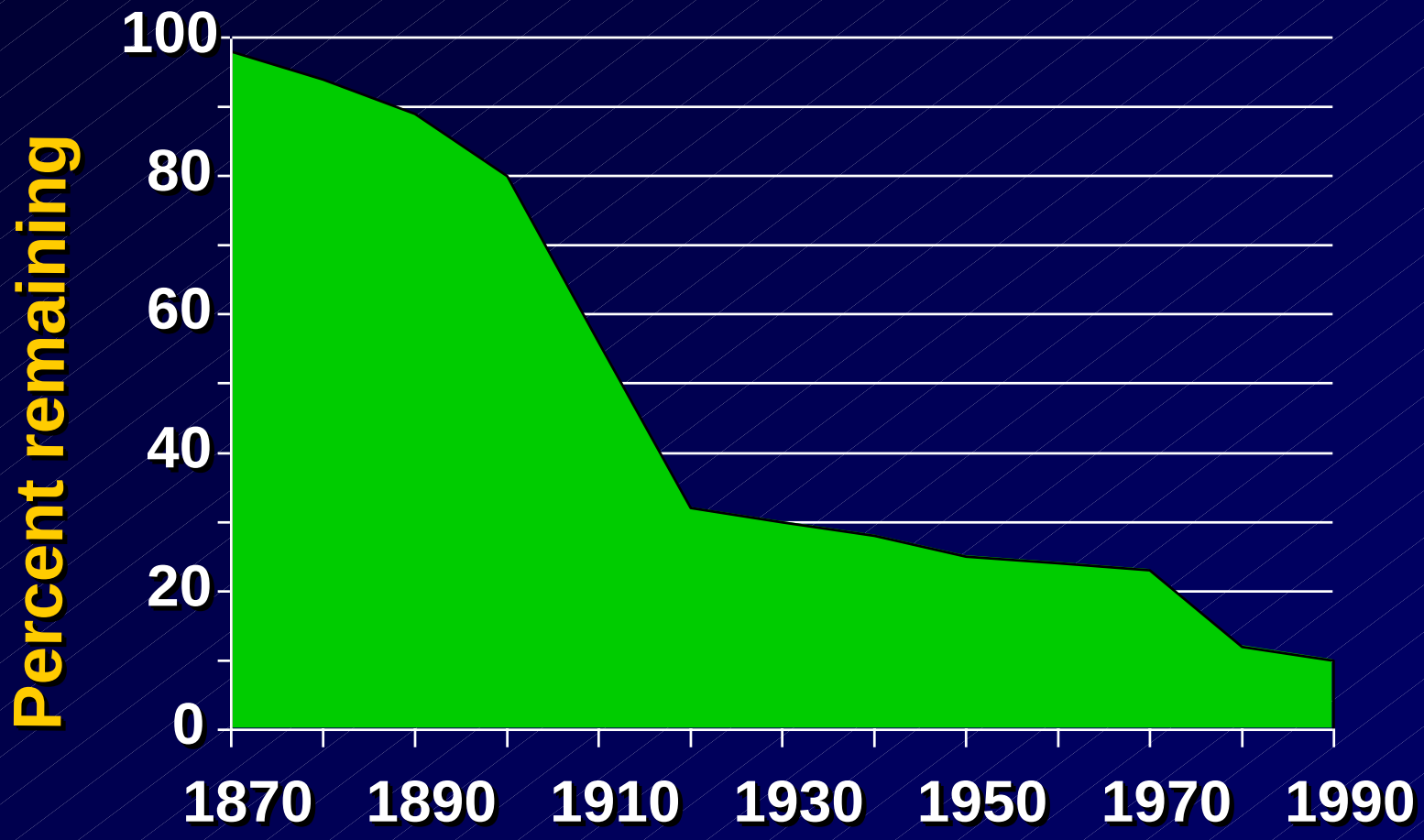
Declining Biodiversity

Western Riparian Wetlands

- Narrow strips of forests in arid regions
- Typically flood in spring with snowmelt
- Vegetation characterized by cottonwoods, willows, green ash, box elder, American elm, bur oak
- 95% altered or lost in last 100 years

Competition for Limited Water

North Dakota Native Grassland

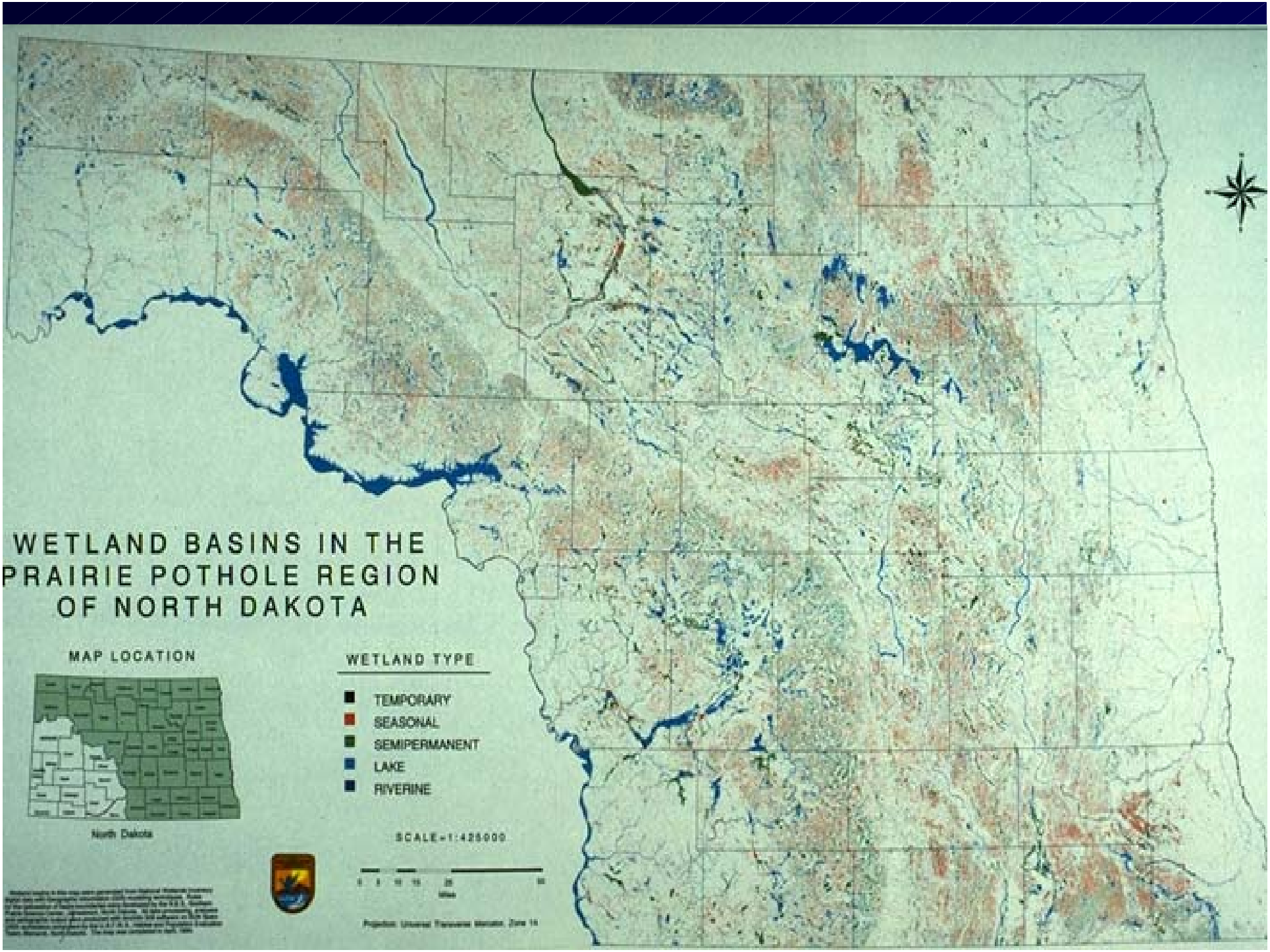


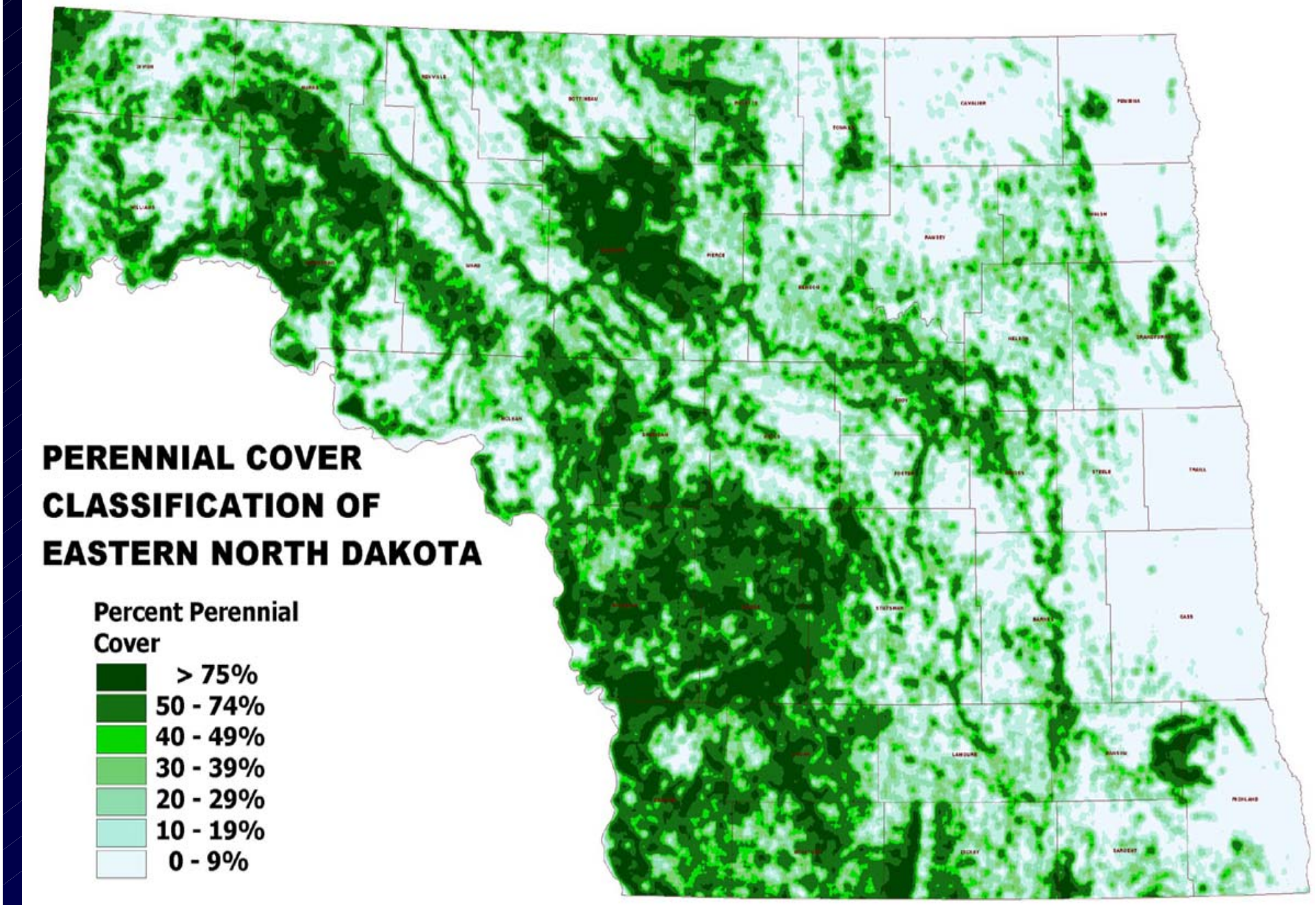
Effects of Grassland Loss

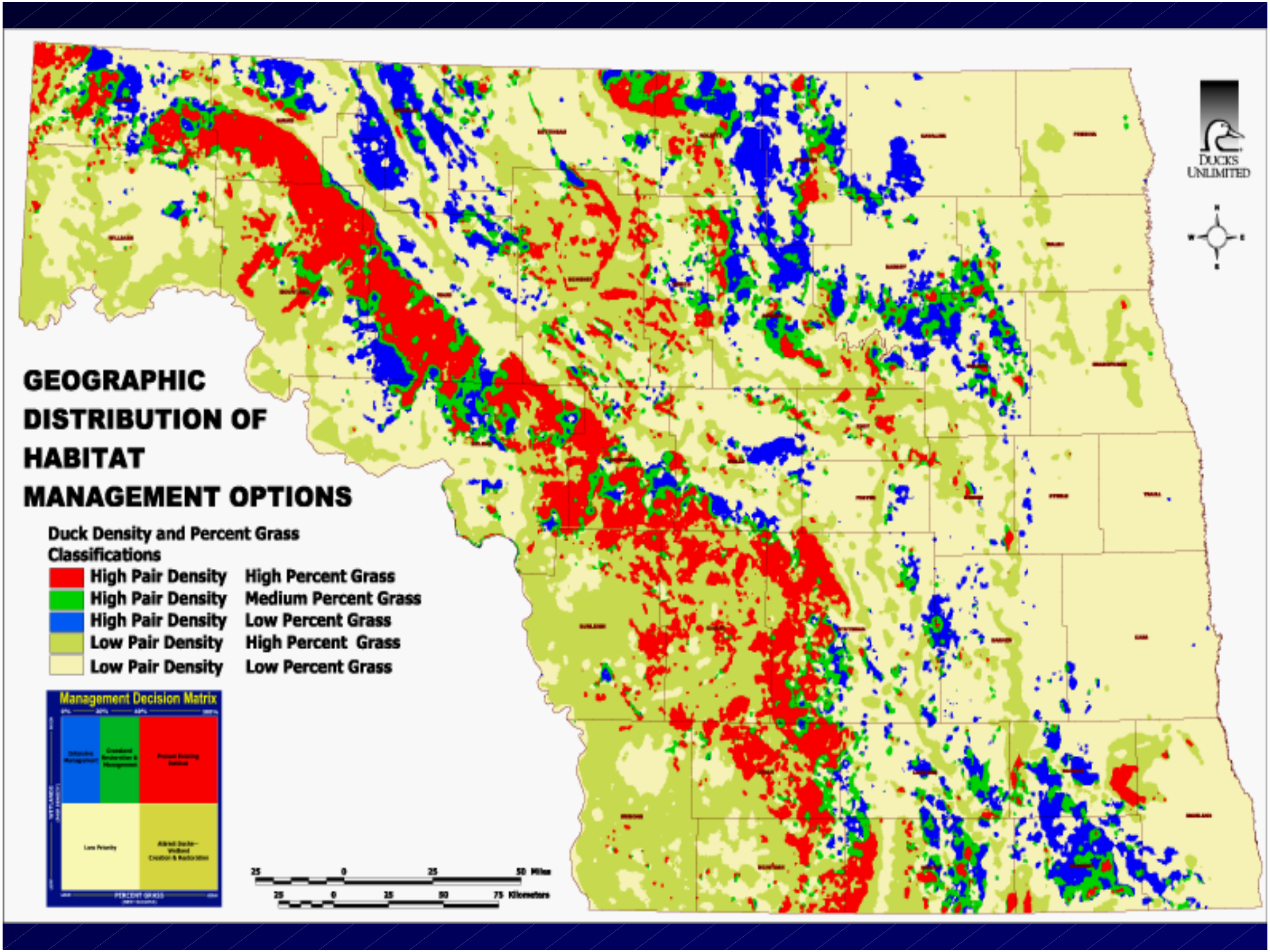
- Increased Predation

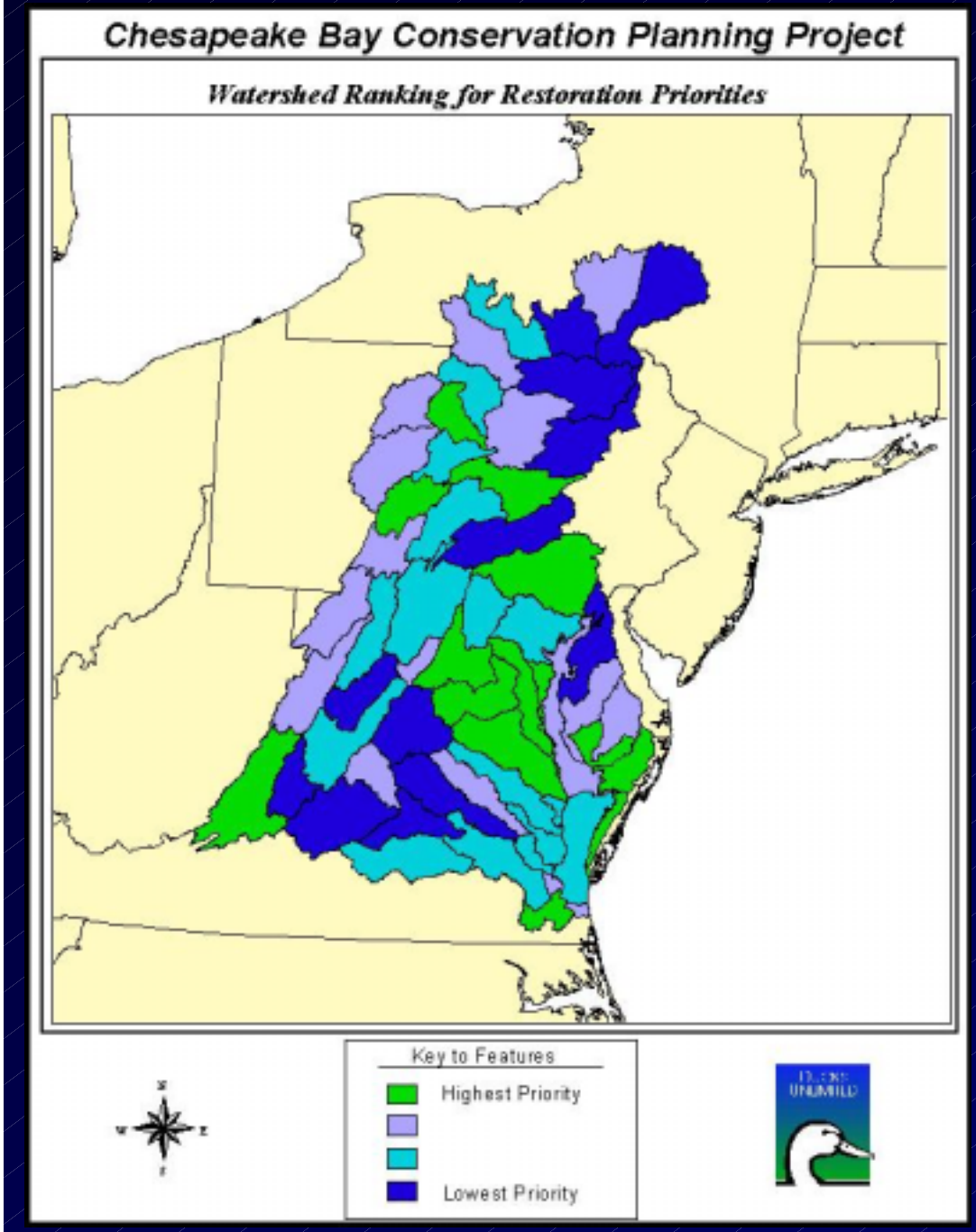
Restoration Planning

- Landscape Level
- Site-specific Level


WETLAND BASINS IN THE PRAIRIE POTHOLE REGION OF NORTH DAKOTA
MAP LOCATION
North Dakota
WETLAND TYPE
TEMPORARY
SEASONAL
SEMIPERMANENT
LAKE
RIVERINE
SCALE = 1:425000
Miles


PERENNIAL COVER
CLASSIFICATION OF
EASTERN NORTH DAKOTA
Percent Perennial
Cover
> 75%
50 - 74%
40 - 49%
30 - 39%
20 - 29%
10 - 19%
0 - 9%


GEOGRAPHIC
DISTRIBUTION OF
HABITAT
MANAGEMENT OPTIONS
Duck Density and Percent Grass
Classifications
High Pair Density High Percent Grass
High Pair Density Medium Percent Grass
High Pair Density Low Percent Grass
Low Pair Density High Percent Grass
Low Pair Density Low Percent Grass
Management Decision Matrix
25 0 25 50 Miles
25 0 25 50 75 Kilometers
DUCKS UNLIMITED



Problem = Water Quality

- Determine Watersheds In Need of Restoration
- Develop Restoration Projects
- Use Water Quality Models to Measure Success

Critical Processes for Restoration

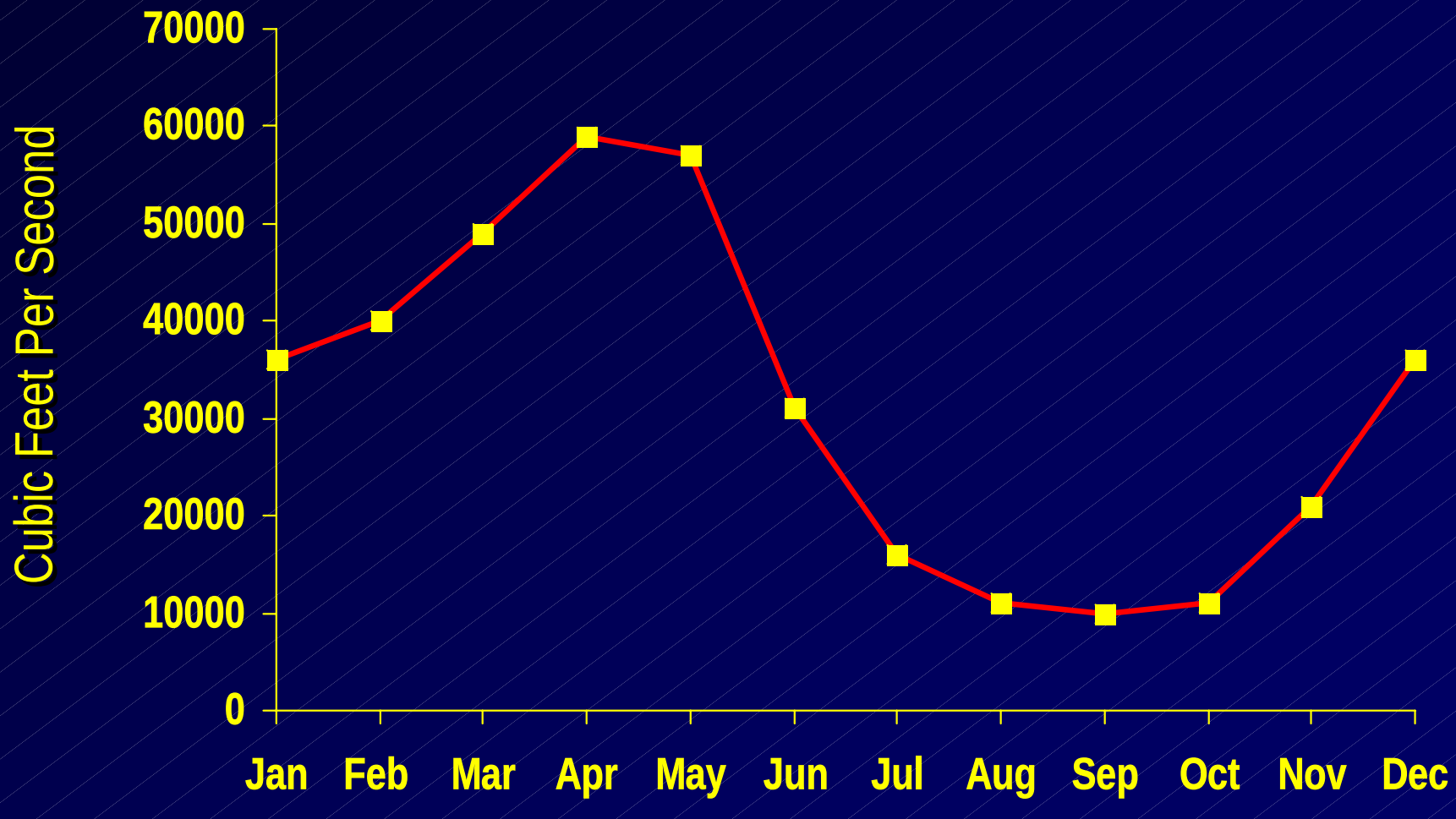
- Hydrology
- Chemistry
- Physical Structure
- Fragment Size
- Connectivity
- Sedimentation and Erosion

Wetland Hydrology

"The depth, duration, timing, and source of flooding"

- **Determines species of vegetation**
- **Determines plant and animal productivity**
- **Vegetation and timing of flooding determines wildlife attracted to site**
- **Fish migrations and spawning often triggered by flooding events**

Typical Bottomland Hardwood Hydrograph



Wetland Biogeochemistry

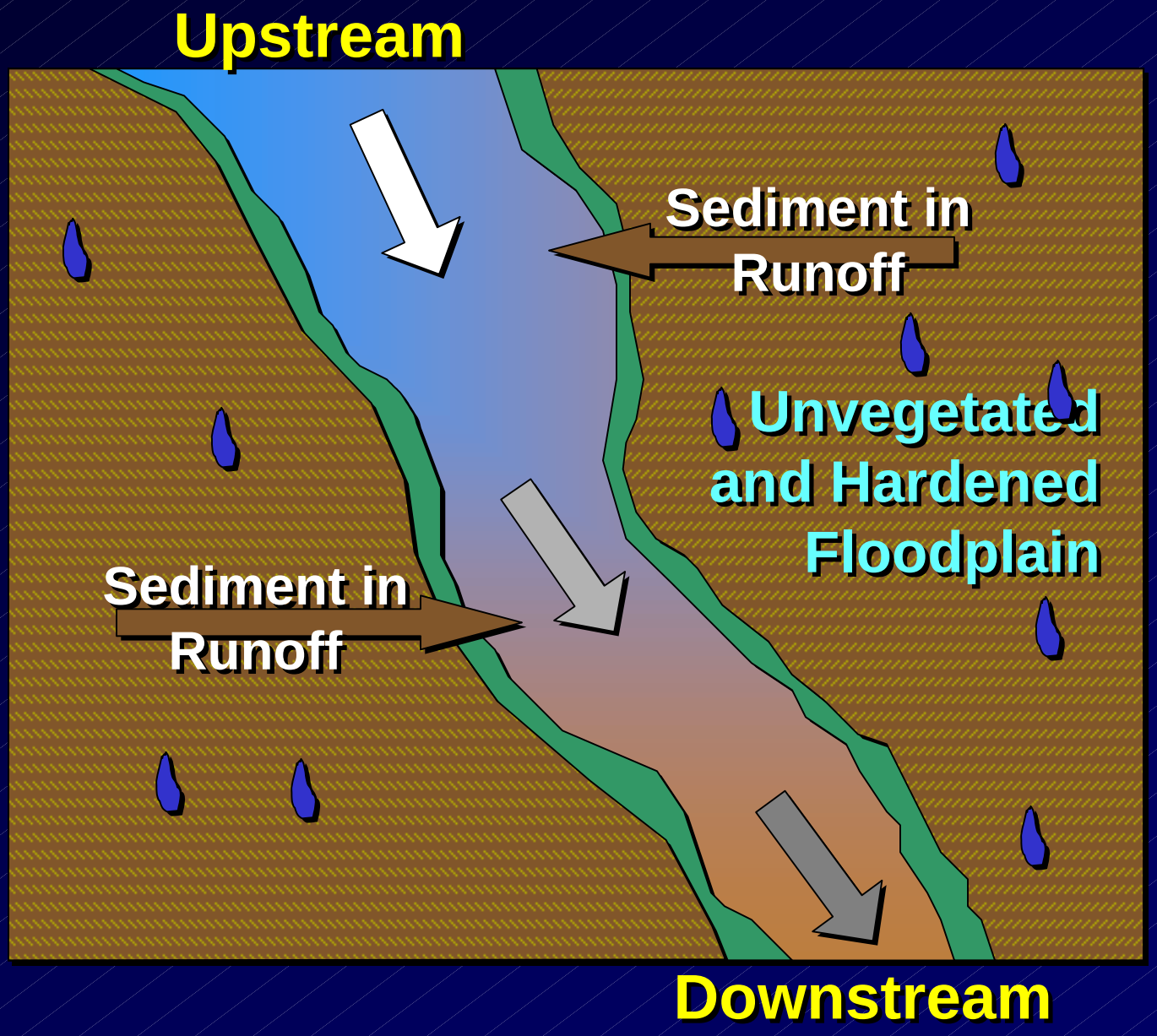
“The major chemical transport and pathways are driven by flood events ”

- **Flooding deprives soil and roots of oxygen, very stressful during growing season**
- **Rich soils replenished by flood events**
- **During flood event waters filtered and purified by wetlands**

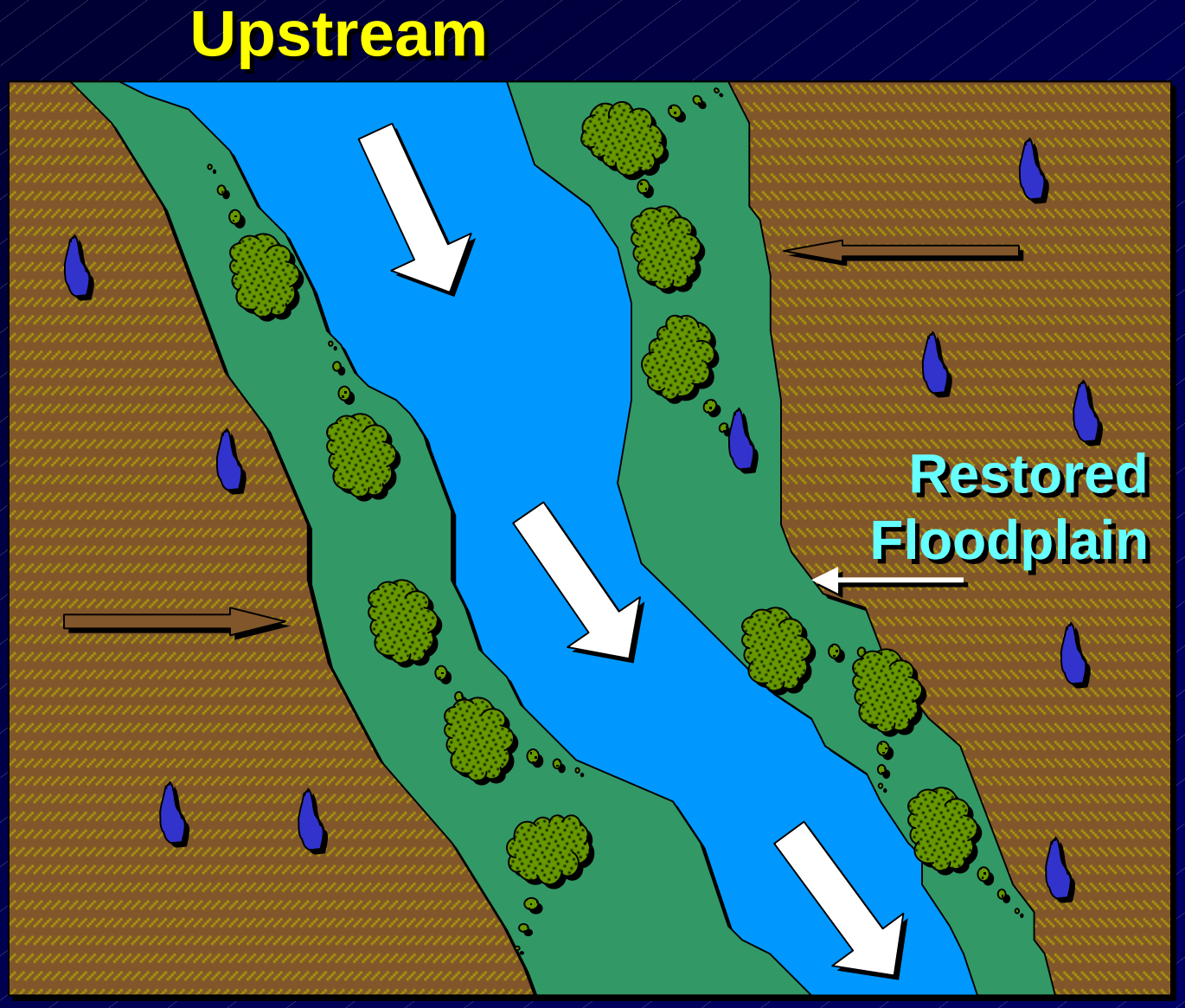
Wetland Nutrient Removal

Type	Location	Nutrient	% Removal
Shrub Bog	Michigan	Nitrogen	71%
Forest Bog	Michigan	Nitrogen	80%
Cypress Swamp	Florida	Nitrogen	90%
Cypress Dome	Florida	Nitrogen	98%
Bottomland Hardwood	South Carolina	Nitrogen	65%

Water Quality Impacts



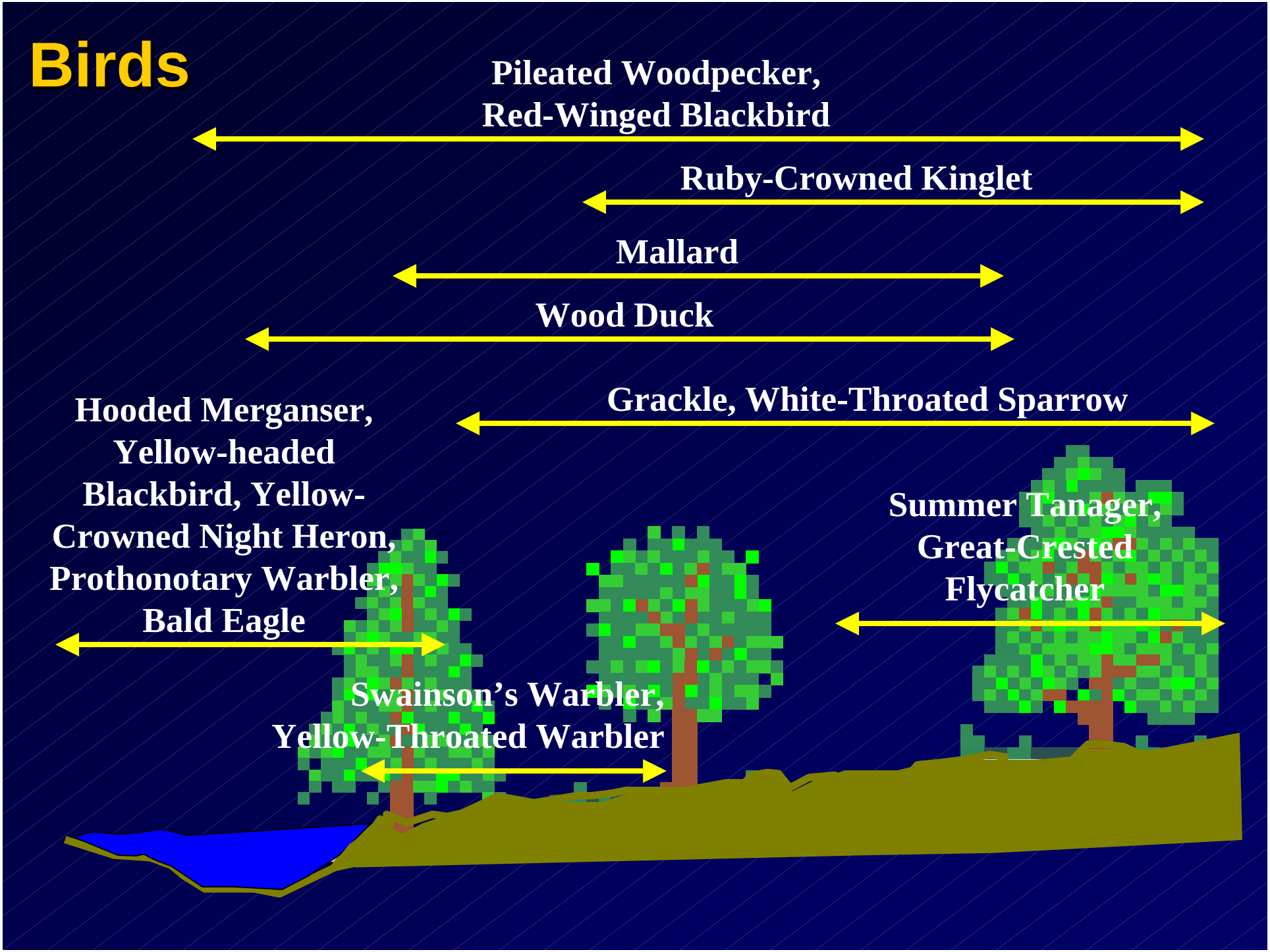
Water Quality Enhancement



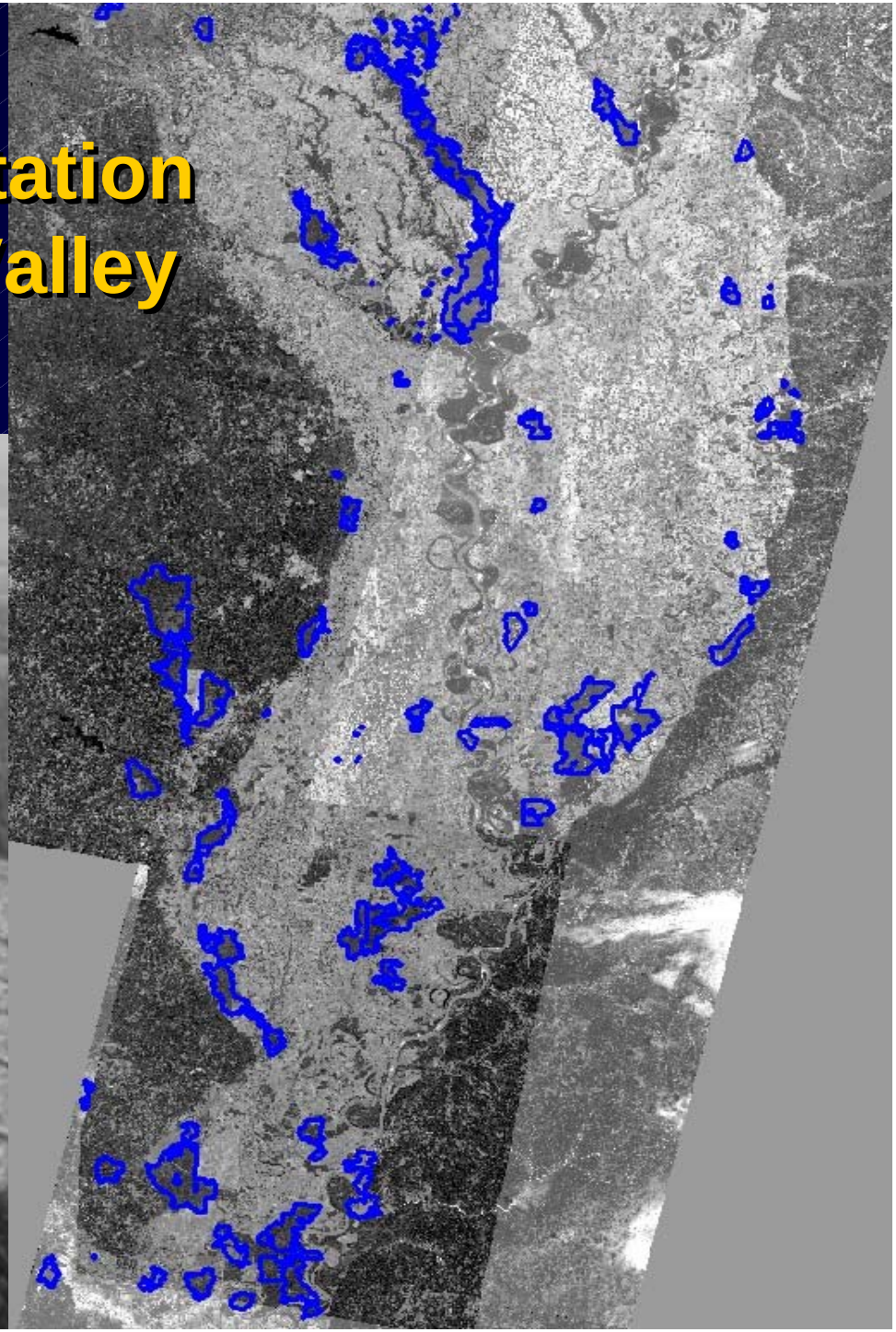
Forested Wetland Structure

- Zonation of plants by elevation (water depth)
- Healthy mix of mature and regenerating trees
- Fish and wildlife respond to water depths and vegetation community
- Fragment size and connectivity

Birds


Pileated Woodpecker,
Red-Winged Blackbird
Ruby-Crowned Kinglet
Mallard
Wood Duck
Hooded Merganser,
Yellow-headed
Blackbird, Yellow-
Crowned Night Heron,
Prothonotary Warbler,
Bald Eagle
Grackle, White-Throated Sparrow
Summer Tanager,
Great-Crested
Flycatcher
Swainson's Warbler,
Yellow-Throated Warbler

Large Scale Fragmentation
Mississippi Alluvial Valley



Choosing a Restoration Site

- Is it a formerly drained wetland? Creation much more difficult
- Is site flooding naturally? Don't fix if not broken
- Low relief and impermeable soils to hold water
- Central channel or drainage canal
- Water source
- Nearby sources of wildlife populations and complex support?

Setting Restoration Goals

- What was there?
- What is adjacent landscape?
- Desired responses? Fish and wildlife populations, water quality, flood control

Restoration Techniques

- Restore native vegetation (seed bank or plant)
- Restore or Enhance Hydrology
- Re-establish Physical Processes
- Implement Management Plan (BMPs)
- Monitor Responses (Populations, water quality, etc.)

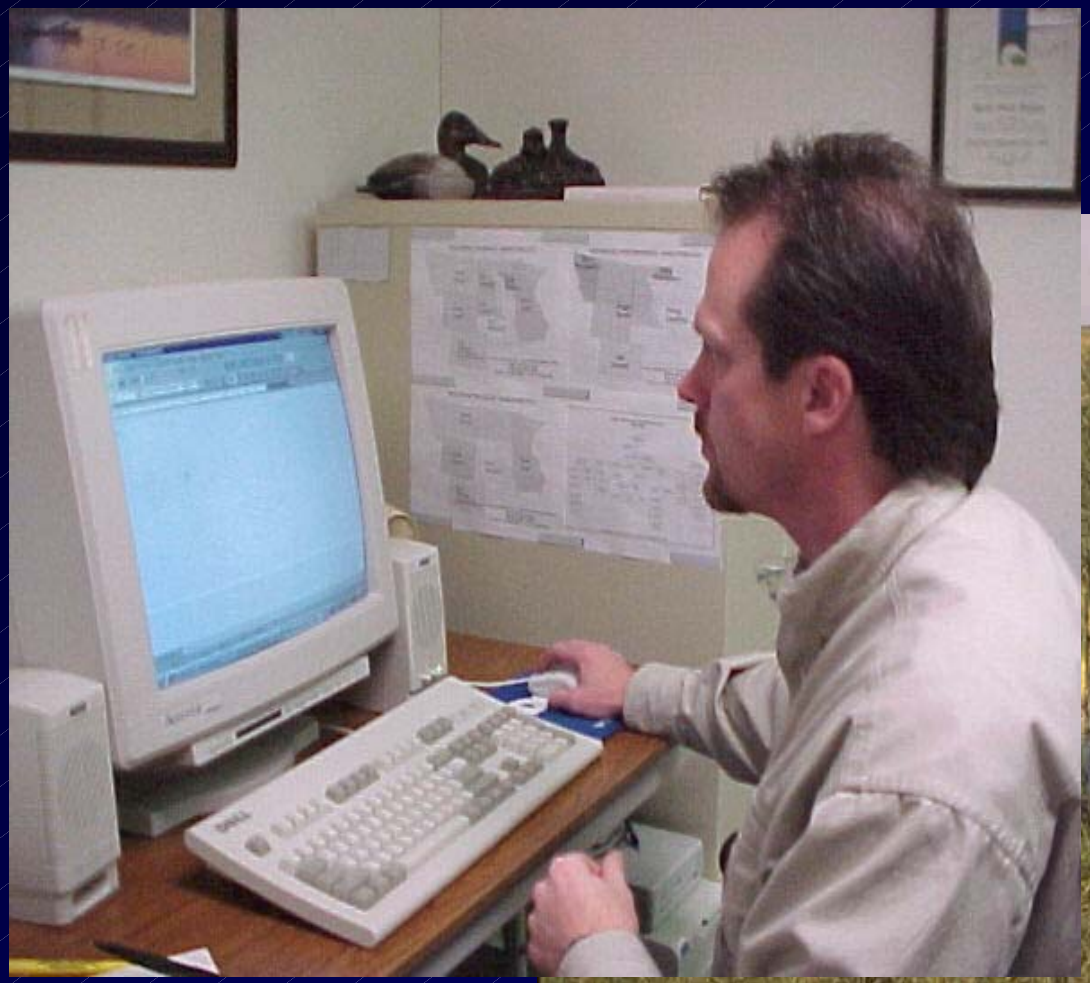
Reforestation Techniques

- Plant bare-root seedlings of 5-7 species at rate of ~300 seedlings/acre
- Plant during dormant season (Dec-Feb)
- Allow gaps for wind borne seeds (willows, cottonwood, red maple, elms, etc.)
- Delay hydrology restoration until seedlings are at least 3-4 feet in height
- 30,000 acres/year in MAV

Restoring Hydrology

- Reconnect floodplain to river if possible if not rely on rainfall or wells as water source
- Construction of low dike and installation of water control structure
- Structures should be large enough to prevent ponding during growing season
- Establishment management plan to simulate natural hydrograph

Survey and Design



Installing Structures

Monitoring and Evaluation

"Adaptive resource management (ARM)"

- Seedling survival
- Water Levels
- Species Composition
- Productivity/Growth
- Wildlife Use

What is Missing?

- Connectivity to river channel
- Sediment and erosion processes
- Filtering of floodwaters through wetlands

What is Rehabilitation?

“Improvements of a visual nature to a natural resource; putting back into good condition or working order”

National Research Council

“True floodplain restoration is impossible unless the hydrologic and geomorphic processes that drive these systems over the long-term are also restored”

Partnerships

- Each bring unique expertise and perspectives to table
- Allows all to leverage funds
- Creates more comprehensive approach
- Builds consensus within communities
- Majority of opportunities on private lands

Partnership Opportunities

DUCKS UNLIMITED

&

U.S. Army Corps of Engineers

Southern Region

Past Success

Project	Location	Acres	DU Role
Salt Bayou	Texas	55,000	Sponsor
Dyer Lake	Arkansas	38	Design/Build
Demopolis	Alabama	130	Survey/Design
Mahannah	Mississippi	5,000	Consultant
Wildcat Brake	Mississippi	80	Design/Build

Great Plains Region

Past Success

Project	Location	Acres	DU Role
Mud Lake	South Dakota	3,926	Design/Build
Sanish Bay	North Dakota	30	Survey/Design
Lewis & Clark	North Dakota	715	Design/Build
Bowman-Haley	North Dakota	79	Design/Build
Santa Fe Slough	Colorado	42	Sponsor

Great Lakes/Atlantic Region

Past Success

Project	Location	Acres	DU Role
Reds Landing	Illinois	641	Sponsor
Carlyle Lake	Illinois	3,334	Design/Build
Wabash River	Indiana	138	Design/Build
Kerr Reservoir	Virginia	27	Design/Build

- Proje
- Nomi
  awarc

Specific Future Opportunities

- Cache River, Arkansas – reestablishing river meanders.
- Galla Creek, Arkansas – dewater forested wetland to allow tree regeneration.
- Carbon City, Arkansas – enhance wetland water management.
- Tarrant County, Texas – wetlands tailwater recovery system for water district.

General Future Opportunities

- Provide biological and engineering design for wetland restoration portions of larger flood control projects.
- Provide GIS modeling for targeting restoration sites.
- Receipt of in lieu mitigation funds, could be expanded across the country.
- Sponsor projects.

Common Ground

- Wetland restoration required to:
  - Replenish dwindling water supplies
  - Help solve hypoxia in estuaries
  - Help reduce greenhouse gases
  - Help recovery of declining species
- Many opportunities to combine our organizational strengths
- Good soil and water conservation will benefit all of society